NETWORK DEVELOPMENT SYSTEM II (NDS-II)
iMDX-450

NDS-II is a local area network (LAN) of development systems which share resources coordinated by the Network Resource Manager (NRM). The NRM and workstations are interconnected using the 10 megabit/second Ethernet technology. All existing Intel development systems can be upgraded to become NDS-II workstations. In addition, low-cost software workstations are available.

This distributed processing LAN provides:

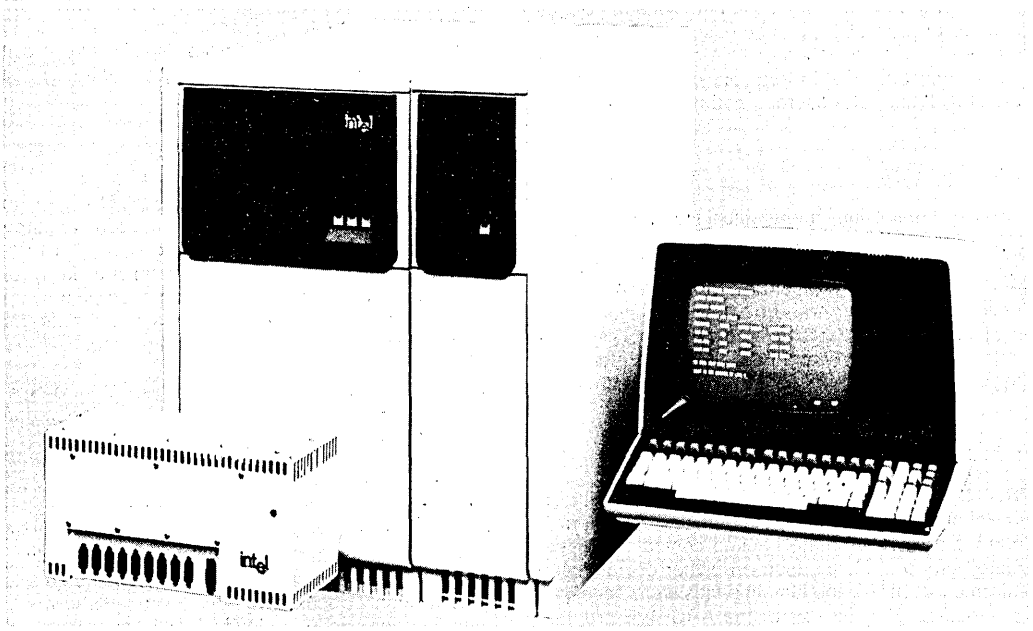
- **Central, Shared Mass Storage Using New or Existing Winchester and Hard Disk Subsystems**
- **Efficient, Intelligent Archival Facilities on Convenient Cartridge Tape Media**
- **A Spooled Line Printer Shared Among All Workstations**
- **Support for All Existing Intellec® Development Systems as Network Workstations**
- **Support for Low Cost ISIS Cluster Software Workstations**
- **A Protected Hierarchical File System**
- **Job Queues that Allow Users to Export Jobs to Other Available Network Workstations**

NDS-II provides the ideal environment for microcomputer development. Software and hardware engineering tools are used most effectively in conjunction with the project management aids provided in this networked host environment. Development equipment cost and product development time are reduced.

NDS-II hosted tools are optimized for the following tasks:

- **Project Organization**
- **Software Version Control**
- **Automated Software System Generation**
- **Electronic Mail Communication**
- **Source Code Creation and Compilation**
- **High-Level Language Debugging**
- **Hardware/Software Integration**
- **In-Target Software Debugging**

The entire spectrum of Intel microcomputer architectures is supported by complete sets of tools: programming languages, software debuggers, in-circuit emulators, PROM programmers, and system tools.



OVERVIEW

NDS-II is a distributed processing LAN optimized for development of microcomputer-based products. It addresses the needs of software engineers, hardware engineers, and engineering management by providing the base environment for development tools and management aids. NDS-II has the capacity to expand to create a network tailored to the needs of any project team.

FUNCTIONAL DESCRIPTION

The Network Resource Manager (NRM) manages all workstation requests for network resources. NRM tasks include the servicing of workstation file requests from the central hierarchical file system, spooling and printing of workstation print requests, routing of electronic mail messages, and queuing and assignment of remote job execution requests. The NRM is also used to perform network maintenance functions such as user name creation, configuration selection, back-up of the central file system, and file system maintenance.

The NRM and workstations communicate via iNA (Intel Network Architecture), which is based on Ethernet communications protocol. The physical Ethernet connections can be made through a low-cost Intellink™ module, through transceivers and Ethernet coaxial cable, or through some combination of these options.

All existing Intellec® Development Systems, Series II, III, IV or Model 800, can be used as NDS-II workstations. The workstations retain all of their standalone functions and, in addition, can access all of the NDS-II shared resources and network services.

File System

The NRM maintains a hierarchical file system, allowing a logical and systematic organization of files. This file system is shared by all network users, and the access to an individual file or directory is controlled by its creator and the Superuser (system administrator.) A centralized archival facility is available, allowing convenient backup of files stored on the shared disks.

Intelligent Archival

The NDS-II ARCHIVE program provides selective archival of files in the shared hierarchical file system. It can incrementally create backup copies of any selected group of files, based on owner or pathname information and/or the last time files were accessed or modified. Regular use of the ARCHIVE program to store files onto tape cartridges or other secondary storage devices ensures security of critical project files.

Distributed Job Control

NDS-II offers distributed processing with local workstation resources and remote network resources. Queues are created at the NRM, where batch jobs are "exported" from some workstations, and "imported" by others for execution. This allows otherwise idle workstations to be utilized, and gives 8-bit workstation users access to 16-bit capabilities. In addition, the Series IV, with its multitasking capability can "import" jobs in one partition while continuing interactive user operations in the other.

Print Spooling

A user-supplied line printer may be attached to the NRM. This allows the line printer to be used as a shared network resource, freeing up workstation processor time and eliminating the need to supply one printer per workstation. Any network user can send print jobs to the spooler queue at the NRM, where they are printed on a FIFO basis.

Tools

All current Intel development tools such as assemblers, high-level language compilers, linkers/locators, software debuggers, and in-circuit emulators can be used on NDS-II workstations. In addition, there are two new tools designed specifically to suit the needs of multi-engineer projects utilizing the NDS-II development environment.

PROGRAM MANAGEMENT TOOLS

Intel's Program Management Tools (PMTs) provide the essential services to efficiently manage large software-intensive development projects. PMTs decrease the amount of time spent on tracking program changes and manually generating software systems, thereby giving engineers more time for software design, development, and testing.

The PMTs consist of "Software Version Control System" (SVCS) and an automated software generation facility (MAKE).

SVCS controls and documents software changes for all file types. SVCS handles storage and retrieval of different versions of a given module, controls update privileges, prevents different users from making changes independently, and requires all changes to be thoroughly documented by recording who made what change, when, and why.

MAKE produces the specification of a "minimum work" job required to generate a new system. This job (i.e. a SUBMIT file) typically includes compiles and links of the latest versions of specified source and object modules. If a newer source module exists for any specified object module, MAKE will specify a compile of this module, replacing the older module in the completed program. Unnecessary links and compiles are eliminated. MAKE does the minimum work required to ensure consistent, up-to-date software thus saving many hours of compiles and links.

The close relationship between SVCS and MAKE helps simplify the overall job of software control. For example, the very latest version of a source module may not be stable enough to be included in a software generation. A less functional, but more reliable version may exist. Since SVCS keeps unique versions distinct, an SVCS module containing the more stable version may be specified for use by MAKE.

ELECTRONIC MAIL

Electronic Mail enables users to send and receive messages and files between any nodes on the NDS-II. Mail maintains a directory called the "post office" which contains user mailboxes (accessible to only a single user), group mailboxes (accessible by a selected group of users), and bulletin board mailboxes (accessible by any user). Users can send interactively created messages, or text or object files, to any mailbox type.

Users can interactively read their mail, save messages in a file, forward messages to other users, and reply to message senders. Or, if they prefer, users may request a simple mailbox summary which includes, for each message, the sender's name, date sent, urgency, and message type (text or object).

NDS-II PMTs and Mail execute on all existing NDS-II workstations, including Series II, Series III, Series IV, Model 800, and ISIS Cluster.

HARDWARE COMPONENTS

Network Resource Manager

The NRM is a free standing unit containing thirteen MULTIBUS® card slots, an integrated 5-¼" flexible disk drive, and an optional cartridge tape subsystem. Processors, memory, and the Ethernet Controller (iSBC-550) occupy six of the card slots. Some of the remaining card slots are used for the various mass storage device controllers.

The NRM is delivered with a console terminal, Intellink module, 50 foot transceiver cable, 10 foot shielded printer cable (with Centronics parallel interface), and 35Mb peripheral-box support accessories. The iNDX Operating System, Program Management Tools, and Electrical Mail software and documentation are also provided.

Intellink™ Module

The Intellink module is a communication device used to connect all NDS-II components (the NRM and workstations) within a local proximity. It serves as a Ethernet local station concentration and provides full Ethernet functionality.

Each Intellink module has nine transceiver ports for connecting workstations and the NRM (via transceiver cables only), plus one Ethernet port for connecting to Ethernet cable (via transceiver and transceiver cable) or to a second Intellink (via the adapter included and a transceiver cable.)

Upgrades

Creating a network in your development environment is accomplished by inserting communication board upgrades in your existing development systems, and by adding a Network Resource Manager. The resources of the network can be incrementally expanded as your development needs increase. Workstations can be added, mass storage increased, and new software tools integrated.

SYSTEM CAPACITY

NDS-II has been designed to efficiently handle the needs for mass storage expansion, increase in the number of users, and expansion of the development laboratory physical size. These needs are met in the following ways:

Storage

NDS-II users may add winchester disk storage capacity to the NRM using peripheral attachments. Each peripheral attachment can contain two 84 megabyte 8" winchester drives. The NRM can support up to two peripheral attachments.

In addition, up to two existing Model 740 Hard Disk Subsystems can be connected to the NRM for use as shared network storage devices. One Model 750 35Mb Winchester Drive Subsystem can be attached to the NRM (if no 35 megabyte peripherals are attached.)

An optional Cartridge Tape Subsystem can be installed in the NRM chassis to provide convenient back-up onto standard 12 megabyte tape cartridges.

Users

NDS-II allows multiple users to access the system via workstations that are attached to NRM via Ethernet technology. Up to 16 Intellec workstations can be incorporated into NDS-II. A maximum of 28 active users can be supported on the network, though the feasibility of such a configuration varies with network loading and workstation types.

Geography

NDS-II can be expanded to connect local development groups in different locations throughout a building. Within a 50-meter radius, up to eight Intellec workstations can be attached to the NRM using a single Intellink module. Within a 75-meter radius, a total of sixteen Intellec workstations can be attached using two Intellink modules. Alternatively, or in conjunction with one or more Intellink modules, Ethernet coaxial cable and transceivers can be used to connect any or all of the workstations and the NRM along a maximum of 1 kilometer of Ethernet coax.

WORKSTATIONS

Intellec® Workstations

All Intellec development systems produced since 1975 can be used as NDS-II workstations. These include: Model 800, Series II, Series III, and Series IV.

Development systems must be upgraded with the communication boards, cables, and the appropriate software. See Ordering Information for the product code of the kit that corresponds to your present Intellec System.

Low-Cost Workstations

ISIS Cluster Board Packages provide additional, inexpensive workstations on NDS-II. Each Cluster Package includes an 8085 CPU, 4K of ROM (bootstrap and dianostics), and 64K of RAM. The Cluster Board must be hosted in an Intellec workstation (Series II, Series III, Series IV, or Model 800 workstation) with which it shares the power supply and network communication boards.

When attached to the RS232C port of a user-supplied terminal, an ISIS Cluster workstation will boot onto the network and provide an ISIS environment which can run all Intellec-supported 8-bit software and EXPORT jobs to other network resources.

CONNECTION TO OTHER EQUIPMENT

iRMX™ System Interface

iRMX-based microcomputer systems (86/330, 86/380, 86/310) can be connected directly to NDS-II using the iNA-955 NDS-II/iRMX Link software package and the iSBC-550 Communication Board Package. iRMX system developers can use the development system environment of NDS-II to develop their application and then download at Ethernet speed to the iRMX target system(s). The iRMX Link also provides a programatic interface to NDS-II, which allows iRMX OEMs to develop customized network environments.

VAX* Interfaces

The iMDX-394 and iMDX-395 Asynchronous Communication Link products can be used to connect VAX/VMS and VAX/UNIX general computing environments to the NDS-II development environment. The Communication Link operates via a serial connection to any NDS-II workstation and allows files to be uploaded or downloaded between the VAX and NRM mass storage devices.

Contact your local Intel Sales Office for information about the Ethernet-based link for VAX/VMS.

iPDS™ Development System, IBM-PC, and Other Interfaces

A program available from the INSITE User's Program Library can be used to connect the IBM-PC and the iPDS Development System to NDS-II. The interface is composed of an ISIS Cluster board which is connected via RS232C to the PC or iPDS, and via Ethernet to the NRM. Source code is provided, and can be adapted to suit other systems.

SUPPORT

Site Preparation/Configuration Guide

A site preparation manual, the "NDS-II Configuration and Ordering Guide" (order # 121969) is available. The manual assists the future NDS-II owner in both configuring a network suited to his needs and in preparing the physical area for the new system.

* VAX is a registered trademark of Digital Equipment Corporation

Installation/Warranty

Within Intel service areas, on-site installation is currently included in the price of the Network Resource Manager. In addition, 90-day on-site maintenance, including parts and labor is currently included. Service contracts for periods beyond 90 days are currently available. Installation, warranty, and service contracts for locations outside normal service areas are currently available.

The NRM also currently includes 90 days of initial support, consisting of software updates/releases (if available), and subscription services (telephone hotline support, software performance report service, and technical reports.) To receive this support, the customer must mail in the software registration card. Additional software support beyond 90 days is currently available.

On-Site Training/Technical Assistance

Intel training courses, Field Application Engineers, and System Engineers are available to assist the NDS-II customers in maximizing the benefits of the system. Contact your local Intel representative regarding the services currently available.

SPECIFICATIONS

System Overview

ELECTRICAL CHARACTERISTICS

AC Power Requirement (for NRM with up to 2 peripheral attachments):
- 175V - 260V
- 50Hz or 60Hz
- 15A (maximum)

Control Terminal is available for:
- 110/120V, 50/60Hz, 2A (max)
- or 220/240V, 50/60Hz, 1A (max)

ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: 5 C–35 C
Humidity: 10%–80% non-condensing
Non-Operating Temperature: –10 C–55 C
Electrostatic Discharge (ESD) Tolerance: 8KV*

* Any peripherals added to the system that do not meet Intel's ESD specification will void the ESD portion of the warranty.

Network Resource Manager (NRM)

PHYSICAL CHARACTERISTICS

Width: 16″ (40 cm)
Height: 32″ (80 cm)
Depth: 31″ (78 cm)
Weight: 110 lb (50 kg)

Flexible Disk Drive (integrated in NRM)

Type: 5-¼″ mini-floppy
Density: double sided, double density
Capacity: 656 Kbyte

Cartridge Tape Subsystem (integrated in NRM)

SPECIFICATION

Type: ¼″ tape DC300XL data cartridge
Density: 6400 BPI
Capacity: 12 Megabytes (formatted, using 4K records)
Recording Technique: CGR
Record Size: 1–16 Kbytes

PERFORMANCE

Tape Transfer Rate: 24Kb/sec
Read/Write Speed: 30″/sec
Fast Tape Motion: 70″/sec
Start/Stop: 25 ms @ 30″/sec
75 ms @ 70″/sec

WINCHESTER SUBSYSTEM ("peripheral attachment")

PHYSICAL CHARACTERISTICS

Width: 6″ (16 cm)
Height: 32″ (80 cm)
Depth: 31″ (78 cm)
Weight: 90 lb (41 kg)

DRIVE SPECIFICATION

Type: Winchester Sealed Disk
Capacity: 84 Megabytes (unformatted)
73.92 Megabytes (formatted)
Density: 9950 bit/inch
Recording Technique: MFM
Bytes/Sector: 512
Sectors/Track: 35
Tracks/Surface: 589
Recording Surfaces: 7

DRIVE PERFORMANCE

Disk Transfer Rate:	5 Mbits/sec
Disk Access Time:	
Average	20 ms
Full Stroke	40 ms
Rotational Speed:	3600 rpm

Control Terminal

PHYSICAL CHARACTERISTICS

Logic Box:	19″ W × 14″ D × 3″ H (48 cm × 36 cm × 7 cm)
Video Module:	13″ W × 14″ D × 10″ H (33 cm × 35 cm × 25 cm)
Keyboard:	19″ W × 8″ D × 3″ H (48 cm × 20 cm × 7 cm)
Total Weight:	32 lbs. (15 kg)

HOST INTERFACE

Type:	RS232C
Speed:	110–19.2K baud

CRT

Screen:	12″ diagonal tilt & swivel
Display:	phosphor, P31, green non-glare faceplate
Format:	2 pages (3840 bytes) 24 lines/page 80 characters/line
Cursor:	blinking underscore
Characters:	7 × 9 matrix ASCII character set

KEYBOARD (DETACHABLE)

# Keys:	103
Types:	alpha-numeric typewriter block numeric keypad cursor control & editing block 16 function keys

Intellink™ Module

PHYSICAL CHARACTERISTICS

Width:	14″ (36 cm)
Height:	7.5″ (19 cm)
Depth:	5.5″ (14 cm)
Weight:	5 lb (2.3 kg)

INTERFACES

Transceiver Cable Ports:	9
Ethernet Ports:	1
Adapter:	for Ethernet port (to connect to transceiver port on second Intellink module)

SOFTWARE

iNDX Operating System (including support for Series IV workstations)

ISIS III (N)/III (C) Operating System (for Series II, Series III, Model 800, and ISIS Cluster workstations)

Program Management Tools (8-bit & 16-bit versions)

Electronic Mail (8-bit & 16-bit versions)

NRM Diagnostics

DOCUMENTATION

(Installation and Checkout Manuals are also provided.)

NRM:

NDS-II Network Development System Overview (#121761)

NDS-II Network Resource Manager User's Guide (#134300)

Series II, III, Model 800 Workstations:

NDS-II ISIS-III (N) User's Guide (#121765)

Series IV Workstations:

Intellec® Series IV Operating and Programming Guide (#121753)

ISIS Cluster Workstations:

NDS-II ISIS-III (C) User's Guide Supplement (#122098)

Software:

NDS-II Electronic Mail User's Guide (#122146-001)

A User's Guide to Program Management Tools (#121958)

ORDERING INFORMATION:

Network Resource Managers (see Table 1)

iMDX-450-A000 NDS-II NETWORK RESOURCE MANAGER

Includes 220V NRM Processor Chassis, 110V System Console Terminal, Intellink, 50-meter transceiver Cable, 10-foot Printer Cable, Cabling for One Model 740 Hard Disk and/or one iMDX-750 35Mb Winchester Disk, System Software and Documentation, Program Management Tools, and Electronic Mail.

iMDX-450-B000 NDS-II NETWORK RESOURCE MANAGER

Includes 220V NRM Processor Chassis, 220V System Console Terminal, Intellink, 50-meter transceiver Cable, 10-foot Printer Cable, Cabling for One Model 740 Hard Disk and/or one iMDX-750 35Mb Winchester Disk, System Software and Documentation, Program Management Tools, and Electronic Mail.

iMDX-450-AT84 84Mb NDS-II NETWORK RESOURCE MANAGER

Includes iMDX-450-A000 Network Resource Manager plus 84Mb Winchester Subsystem and 12Mb Cartridge Tape Subsystem.

iMDX-450-BT84 84Mb NDS-II NETWORK RESOURCE MANAGER

Includes iMDX-450-B000 Network Resource Manager plus 84Mb Winchester Subsystem and 12Mb Cartridge Tape Subsystem.

Table 1. Network Resources Managers

Order Code	NRM Voltage	Terminal Voltage	Winchester Subsystem	Tape Subsystem
iMDX-450-A000	220V	110V	not included	not included
iMDX-450-B000	220V	220V	not included	not included
iMDX-450-AT84	220V	110V	84 megabytes	12 megabytes
iMDX-450-BT84	220V	220V	84 megabytes	12 megabytes

NRM Peripheral Upgrades (see Table 2)

iMDX-771-B3 1ST 84Mb PERIPHERAL ATTACHMENT FOR NRM.

Includes one 84Mb Winchester Disk Drive configured as drive 0, cabling to support drive 1, plus the 84Mb Winchester Controller.

iMDX-771-B2 2ND 84Mb PERIPHERAL ATTACHMENT FOR NRM.

Includes one 84Mb Winchester Disk Drive configured as drive 2, and cabling to support drive 3.

iMDX-772 ADD-IN 84Mb DRIVE FOR NRM.

Includes one 84Mb Winchester Disk Drive, to be used as drive 1 or 3 in an iMDX-771 Peripheral Attachment.

iMDX-452 CARTRIDGE TAPE SUBSYSTEM FOR NRM.

Includes Cartridge Tape Drive, Controller, one standard tape cartridge, and accessory kit. Requires iMDX-3008 900 Watt Power Supply for NRMs with serial numbers below 740.

Table 2. NRM Peripheral Upgrades

Order Code	Voltage	Drive Type	Drive #	Controller	Chassis
iMDX-771-B3	220V	84Mb Winchester	0	included	included
iMDX-771-B2	220V	84Mb Winchester	3	*	included
iMDX-772	**	84Mb Winchester	2 or 4	*	***
iMDX-452	**	Cartridge Tape	n/a	included	****

* controlled by existing 84Mb controller in NRM
** operates in 110V or 220V systems
*** second drive in -771-B3/-B2 (or -A1/-B1) chassis
**** fits into NRM chassis

Software Workstations

iMDX-580 ISIS CLUSTER BOARD PACKAGE FOR SERIES II, SERIES III, OR MODEL 800.

Includes processor board, cables, and documentation. Must be installed on NDS-II in a Model 800, Series II, or Series III workstation and attached to a user-supplied terminal.

iMDX-581KIT ISIS CLUSTER BOARD PACKAGE FOR SERIES IV.

Includes iMDX-580 and iMDX-582. Must be installed on NDS-II in a Series IV (or Model 800, Series II, or Series III) workstation and attached to a user-supplied terminal.

iMDX-582 ISIS CLUSTER UPGRADE KIT FOR SERIES IV.

Includes internal cable, mounting hardware, and documentation required to install an existing iMDX-580 ISIS Cluster Board in a Series IV host.

Workstation Kits

iMDX-455 NDS-II WORKSTATION UPGRADE KIT FOR SERIES II/85, SERIES III, AND MODEL 800.

Includes network communication board set, software, and documentation. Transceiver cables must be ordered separately.

iMDX-455I NDS-II WORKSTATION UPGRADE KIT FOR SERIES II/80.

Includes iMDX-455 plus 8085-based CPU board. Transceiver cables must be ordered separately.

iMDX-456 NDS-II WORKSTATION UPGRADE KIT FOR SERIES IV.

Includes network communication board set and documentation. Transceiver cables must be ordered separately.

Cables & Accessories

iMDX-457 10 METER TRANSCEIVER CABLE.

iMDX-458 50 METER TRANSCEIVER CABLE.

iMDX-3016F-1 25 METER ETHERNET COAX ASSEMBLY.

Includes 25 meter (76.8 feet) teflon coaxial cable segment, terminators, and coupler for joining additional coax segments.

iMDX-3016F-2 100 METER ETHERNET COAX ASSEMBLY.

Includes 100 meter (383.9 feet) teflon coaxial cable segment, terminators, and coupler for joining additional coax segments.

iMDX-3015F ETHERNET TRANSCEIVER KIT FOR TEFLON COAX.

iDCM-911-1 INTELLINK MODULE.

Contains 9 transceiver cable ports, plus Ethernet port for optional connection to transceiver or second Intellink (adapter included.)

MDS*-506 HARD DISK CABLE KIT FOR SECOND MODEL 740 ON NRM.

Connects second Model 740 Hard Disk Subsystem to first Model 740, to allow shared NDS-II usage of these mass storage devices. Includes internal cable and I/O cable. (Converts MDS-740 into MDS-743.)

iMDX-450-U11 110V TO 220V UPGRADE KIT FOR NRM AND ONE PERIPHERAL ATTACHMENT.

* MDS is an ordering code and is not used as a product name or trademark. MDS is a registered trademark of Mohawk Data Sciences Corporation.